



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>6</sup> :</b> <b>A22C 9/00</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 98/19550</b> <b>(43) International Publication Date:</b> 14 May 1998 (14.05.98)
<b>(21) International Application Number:</b> PCT/GB97/02904 <b>(22) International Filing Date:</b> 3 November 1997 (03.11.97)  <b>(30) Priority Data:</b> 9622753.3 1 November 1996 (01.11.96) GB  <b>(71) Applicant:</b> MOY PARK LIMITED [GB/GB]; The Food Park, 39 Seagoe Industrial Estate, Craigavon BT63 5QE (GB).  <b>(71)(72) Applicants and Inventors:</b> ELDER, Mark [GB/GB]; 14 Woodford Heights, Cavanaw, Armagh BT60 2DY (GB). DUNN, Adele [GB/GB]; 13 The Knockans, Broughshane, County Antrim BT43 7LQ (GB).  <b>(74) Agent:</b> ROYSTONS; Tower Building, Water Street, Mersey- side, Liverpool L3 1BA (GB).		<b>(81) Designated States:</b> BR, CN, HU, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the</i> <i>claims and to be republished in the event of the receipt of</i> <i>amendments.</i>
<b>(54) Title:</b> IMPROVED METHOD OF RAPIDLY MATURING A RAW CARCASS  <b>(57) Abstract</b>  A method of rapidly maturing a raw carcass by electrical stimulation of pulsed direct current to the carcass. The pulsed direct current provides substantially equal periods of maximum and minimum intensity (square-wave form). The preferred voltage applied across the carcass is 50 volts at a frequency of 10Hz and an intensity of 45 milliamps with the pulsed current being on for 0.075 s and off for 0.025 s. The stimulation is applied for 30 seconds to produce a drop in pH of 0.3 units. The matured carcass is then air chilled.		

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

TITLE: Improved method of rapidly maturing a raw carcass

## DESCRIPTION

The present invention relates to an improved method of effecting rapid maturation of a raw carcass, especially poultry, such as a chicken or turkey.

The carcass of a slaughtered animal or bird is normally chilled for a substantial period of time to allow natural ageing of the carcass before being processed for human consumption. This requires the installation of maturation and chilling facilities hence increasing the amount of equipment and space utilised in the production of a meat food product. Maturation of the carcasses also means that, at any given time, a substantial amount of stock is tied up in storage. Additionally, the transfer of carcasses to a chilling facility requires the handling thereof which leads to increased microbiological contamination with a corresponding reduction in the shelf-life of the food product. It is therefore desirable to be able to effect rapid maturation of a carcass to avoid the necessity for natural ageing thereof.

It is well-established that the application of electrical energy to a carcass assists in the maturation and tenderisation of the carcass thereby removing the need for an extended, low temperature, ageing period. For example, US-A-4358872 (Vanzandt MM) relates to the tenderisation of a meat carcass using a rectal probe to apply electrical stimulation thereto. EP-A-353199 (Eltrn Froll Srl) also discloses a method for the rapid maturation of meat from slaughtered animals by means of electrostimulation. Electrodes are applied to various parts of the slaughtered animal

and supply a pulsed current having a peak voltage of less than or equal to 45 volts, an intensity of less than or equal to 1 ampere and a frequency of 15Hz.

SU-1391566 (E. Sibe Techn. Inst.) describes a process to provide increased tenderisation and a reduced ripening time of meat by applying alternating current through the carcass for three minutes. The current is supplied in pulses, with the duration of each pulse of current being 0.3 to 0.4 seconds having an interval of 0.6 to 0.7 seconds therebetween. The voltage is 220V or 380V with a frequency range from 20 to 60Hz.

Whilst all of the afore-mentioned procedures theoretically result in an increased rate of maturation of a carcass, in practice the processes have not been entirely effective for the tenderization of poultry carcasses as the intensity of the electrical current applied thereto has been found to be detrimental to the eating quality of the meat.

It is therefore desirable to provide an improved method of effecting rapid maturation of a raw carcass whereby post-chill maturation of the carcass may be avoided and which does not adversely effect the quality of the meat produced therefrom.

Accordingly, the present invention provides a method of maturing a raw carcass comprising the step of applying electrical stimulation of pulsed direct current to a carcass for a predetermined period of time characterised by one or more of the following:

- (1) the further step of chilling the carcass after application of the electrical stimulation thereto;

- (2) the pulsed direct current provides periods of maximum intensity (1) substantially equal to periods of minimum intensity (0);
- (3) the voltage is 15-100 volts, preferably 30-50 volts, more preferably above 40 volts, especially being 50 volts; and
- (4) the frequency of the pulsed direct current is less than 50Hz, preferably less than 15Hz, more preferably 8-12Hz, especially 10Hz.

Preferably, the current is switched on for a period of 50-80ms and off for a period of 50-20ms, preferably being on for 70-80ms and off for 30-20ms, especially on for 75ms and off for 25ms.

The intensity of the current applied during the maturation process is in the region of 20-80 milliamps, preferably being 30-60 milliamps and especially being 45 milliamps.

The electrical stimulation may be applied to the carcass immediately after death or alternatively, up to 15 minutes post-mortem. It is preferred that the carcass is subjected to electrical stimulation 90 seconds after death. The stimulation may be applied to the carcass for a continuous period of 5 to 60 seconds, preferably 20 to 40 seconds, but especially being applied for 30 seconds to produce a drop in pH of approximately 0.3 units.

The electrical stimulation may be applied to the carcass, by any suitable means, for example, by means of a probe or electrodes.

Chilling of the carcass immediately after electrical stimulation thereof may be achieved in a variety of ways but preferably, is achieved by rapidly air-chilling the carcass for 1-3 hours at 1-2°C thereby reducing the temperature of the carcass from

body temperature to 5°C.

The application of electrical stimulation to the carcass may be carried out separately from the processing of the carcass whereby a packaged, chilled food product is produced. However, preferably the electrical stimulation is applied to the carcass on a moving line, ie by means of an electrical stimulation station provided at a site along a moving line. The electrically stimulated carcass may then be moved to a chilling station to complete the maturation thereof before being processed and packaged ready for distribution.

It is to be appreciated that the intensity and duration of the electrical stimulation of a carcass to produce the required maturation thereof may vary depending upon a number of factors, such as the age, sex and breed of the bird or animal and on pre-treatment handling.

The present invention will now be further described with reference to the following Example.

#### Example

A live broiler is mounted on a moving line and after death is delivered to an electrical stimulation station for applying electrical stimulation to the carcass, eg. via electrodes, approximately 90 seconds post-mortem.

The electrical energy applied is pulsed DC current and of square-wave form, ie. having periods of maximum intensity (1) equal to the periods of minimum intensity (0). The electrical parameters of the applied stimulation are of particular importance to the method of the present invention. The voltage applied across the carcass is 50 volts at a frequency of 10Hz or 10cps, with an intensity of 45 milliamps

per broiler carcass. The pulsed current is on for 75ms and off for 25ms.

The electrical stimulation is applied to the carcass for 30 seconds to result in a drop of 0.3 units in the pH of the bird. The carcass is then moved by the conveyor to a chilling station at which the carcass is rapidly air-chilled for 90 minutes at 1-2°C. This reduces the temperature of the carcass from body temperature to 5°C.

Following chilling of the carcass, the moving line carries the carcass to further processing stations whereby the carcass is processed and packaged ready for distribution.

The electrical stimulation of the carcass, followed by rapid chilling thereof, induces maturation of the carcass thereby removing the need to provide an extended, low temperature maturation period. This reduces the time taken to process a live animal or bird and leads to a reduction in the amount of space taken up by carcasses during the maturation period. The immediate maturation of a carcass also means that a large amount of stock is not tied up in storage. Furthermore, inducing maturation of the carcass whilst on a moving line removes the need to handle the carcass when being transferred to a chilling facility to mature naturally. Hence, the carcass is exposed to less microbiological activity leading to an extended shelf-life of the resultant food product.

## CLAIMS

1. A method of maturing a raw carcass comprising the step of applying electrical stimulation of pulsed direct current to a carcass for a predetermined period of time characterised by one or more of the following:

- (a) the further step of chilling the carcass after application of the electrical stimulation thereto;
- (b) the pulsed direct current provides period of maximum intensity (1) substantially equal to periods of minimum intensity (0);
- (c) the voltage is 15 to 100 volts; and
- (d) the frequency of the pulsed direct current is less than 50Hz.

2. A method as claimed in claim 1, wherein the voltage is 30 to 50 volts.

3. A method as claimed in claim 2, wherein the voltage is above 40 volts.

4. A method as claimed in claim 3, wherein the voltage is 50 volts.

5. A method as claimed in any one of claims 1 to 4, wherein the frequency of pulsed direct current is less than 15Hz.

6. A method as claimed in claim 5, wherein the frequency is 8 to 12 Hz.

7. A method as claimed in claim 6, wherein the frequency is 10 Hz.

8. A method as claimed in any one of the preceding claims, wherein the current is switched on for a period of 0.05s to 0.08s and off for a period of 0.05s to 0.02s.

9. A method as claimed in claim 8, wherein the current is switched on for a period of 0.07s to 0.08s and off for 0.03 to 0.02s.

10. A method as claimed in claim 9, wherein the current is switched on for a



period of 0.075s and off for 0.025s.

11. A method as claimed in any one of the preceding claims, wherein the intensity of the current applied is between 20 to 80 milliamps.

12. A method as claimed in claim 11, wherein the intensity of current applied is between 30 to 60 milliamps.

13. A method as claimed in claim 12, wherein the intensity of current applied is 45 milliamps.

14. A method as claimed in any one of the preceding claims, wherein the electrical stimulation is applied to the carcass up to fifteen minutes post-mortem.

15. A method as claimed in claim 14, wherein the electrical stimulation is applied to the carcass 90 seconds after death.

16. A method as claimed in any one of the preceding claims, wherein stimulation is applied to the carcass for a continuous period of 5 to 60 seconds.

17. A method as claimed in claim 16, wherein the stimulation is applied for a continuous period of 20 to 40 seconds.

18. A method as claimed in claim 17, wherein the stimulation is applied for a continuous period of 30 second.

19. A method as claimed in any one of the preceding claims, wherein the stimulation is applied to produce a drop of pH of approximately 0.3 units.

20. A method as claimed in any one of the preceding claims wherein the carcass is rapidly air-chilled for 1 to 3 hours at 1 to 2°C thereby reducing the temperature of the carcass to about 5°C.

21. A method as claimed in any one of the preceding claims, wherein the

electrical stimulation of the carcass is applied to the carcass at an electrical stimulation station on a moving line prior to a chilling station.

22. A method of rapidly maturing a raw carcass substantially as hereinbefore described with reference to the accompanying Example.

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 97/02904

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 A22C9/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A22C A22B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 032 110 A (AB SIMRISHAMNS) 15 July 1981 see the whole document	1-22
X	GB 2 147 791 A (VYSKUMNY USTAV ZIVOCISNEJ VYROBY) 22 May 1985 see the whole document	1-22



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

### \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

26 March 1998

Date of mailing of the international search report

02/04/1998

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl.  
Fax: (+31-70) 340-3016

Authorized officer

von Arx, V.

# INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/GB 97/02904

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 32110 A	15-07-81	SE 416869 B	16-02-81
		AU 6148880 A	11-06-81
		AU 7910052 A	11-06-81
		JP 56082046 A	04-07-81
		WO 8101641 A	25-06-81
<hr/>			
GB 2147791 A	22-05-85	NONE	
<hr/>			